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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/665,322      | 09/20/2003  | William J. Murphy    | BUR9-1999-0044US2   | 6242             |

7590 04/07/2004  
Robert A. Walsh  
1000 River St. 972E  
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EXAMINER

WARREN, MATTHEW E

ART UNIT PAPER NUMBER

2815

DATE MAILED: 04/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/665,322

Applicant(s)

MURPHY, WILLIAM J.

Examiner

Matthew E. Warren

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2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 20 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 18-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 18-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 9/20/03.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

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## **DETAILED ACTION**

This Office Action is in response to the Preliminary Amendment filed on September 20, 2003.

### ***Claim Objections***

Claim 20, 27, and 31 are objected to because of the following informalities: claim 20 recites the limitation of "...said first conductive layer." Claims 27 and 31 recite the limitation of "...said refractory metal." There is insufficient antecedent basis for these limitations in the claim. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 18-32 are rejected under 35 U.S.C. 102(e) as being anticipated by Brennan (US 6,211,072 B1).

In re claim 18, Brennan shows (fig. 6) a refractory metal liner (28) comprising a barrier (TiN) comprising a passivating agent (nitrogen). The barrier impedes a subsequent reaction of a top half of the refractory metal liner with an adjacent

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conductive layer (18) (col. 5, lines 49-67). The amount of the passivating agent in the barrier is less than an amount necessary to form a stoichiometric combination of the refractory metal liner and the passivating agent since other elements such as carbon or formed and then removed from the liner (col. 5, line 57 – col. 6, line 7).

In re claim 19, Brennan discloses that the barrier is positioned in a central portion of the refractory metal because the passivating agent of nitrogen is formed through the entire TiN layer.

In re claims 20 and 21, Brennan inherently discloses that the barrier impedes impurities from diffusing from a first conductive layer (18) through the refractory metal since TiN nitride naturally impedes silicon and fluorine. (Chen et al. [US 5,874,356] in col. 1, lines 47-57 that TiN has barrier properties that protect against the diffusion of silicon from the substrate and fluorine from subsequent tungsten deposition).

In re claims 22 and 23, Brennan shows (fig. 6) that a second conductive layer (26) is positioned over the refractory metal (28). The barrier impedes impurities from diffusing from the second conductive layer. The impurities comprise fluorine (col. 5, lines 49-67).

In re claim 24, Brennan discloses that the refractory metal liner comprises titanium and the passivating agent comprises nitrogen (col. 5, lines 49-67).

In re claim 25, Brennan discloses (fig. 6) an electrical connection in an integrated circuit chip comprising a first conductive layer (18), and a liner (28) on the first conductive layer. The liner includes a barrier (nitrogen) that impedes impurities from

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diffusing from the first conductive layer through the liner. A second conductive layer (26) is formed over the liner and also impedes impurities from diffusing from the second conductive layer through the liner (col. 5, lines 49-67).

In re claim 26, Brennan discloses that the amount of the passivating agent in the barrier is less than an amount necessary to form a stoichiometric combination of the refractory metal liner and the passivating agent since other elements such as carbon or formed and then removed from the liner (col. 5, line 57 – col. 6, line 7).

In re claim 27, Brennan discloses that the refractory metal liner comprises titanium and the passivating agent comprises nitrogen. The second conductive layer comprises tungsten (col. 5, lines 49-67).

In re claim 28, Brennan discloses that the impurities comprise fluorine (col. 5, lines 49-67). Brennan inherently discloses that the barrier impedes impurities from diffusing from a first conductive layer (18) through the refractory metal since TiN nitride naturally impedes silicon and fluorine. (Chen et al. [US 5,874,356] in col. 1, lines 47-57 that TiN has barrier properties that protect against the diffusion of silicon from the substrate and fluorine from subsequent tungsten deposition).

In re claim 29, Brennan shows (fig. 6) an integrated circuit chip comprising a first conductive layer (18), and a liner (28) on the first conductive layer. The liner includes a barrier (nitrogen) that impedes impurities from diffusing from the first conductive layer through the liner. A second conductive layer (26) is formed over the liner and also

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impedes impurities from diffusing from the second conductive layer through the liner (col. 5, lines 49-67).

In re claim 30, Brennan discloses that the amount of the passivating agent in the barrier is less than an amount necessary to form a stoichiometric combination of the refractory metal liner and the passivating agent since other elements such as carbon or formed and then removed from the liner (col. 5, line 57 – col. 6, line 7).

In re claim 31, Brennan discloses that the refractory metal liner comprises titanium and the passivating agent comprises nitrogen. The second conductive layer comprises tungsten (col. 5, lines 49-67).

In re claim 32, Brennan discloses that the impurities comprise fluorine (col. 5, lines 49-67). Brennan inherently discloses that the barrier impedes impurities from diffusing from a first conductive layer (18) through the refractory metal since TiN nitride naturally impedes silicon and fluorine. (Chen et al. [US 5,874,356] in col. 1, lines 47-57 that TiN has barrier properties that protect against the diffusion of silicon from the substrate and fluorine from subsequent tungsten deposition).

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### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Chen et al. (US 5,874,356), Allman et al. (US 5,963,828), and Yin et al. (US 6,150,257) also show contact structures having barrier liners.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Warren whose telephone number is (571)

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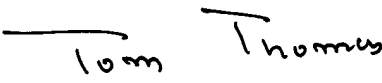
272-1737. The examiner can normally be reached on Mon-Thurs, and alternating Fri, 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MEW

April 5, 2004

  
Tom Thomas  
Supervisory Patent Examiner  
Technology Center 2815